

MATH STANDARDS

STANDARD 1: NUMBER SENSE

Students develop number sense and use numbers and number relationships to acquire basic facts, to solve a wide variety of real-world problems, and to determine the reasonableness of results.

READINESS (Kindergarten)

- **1M-R1. Develop an understanding of number meanings and relationships**
- **1M-R2. Demonstrate one-to-one correspondence between elements in collections (sets) (e.g., nine blocks is as many as nine ducks)**
- **1M-R3. Use manipulatives (concrete materials) to count, order and group**
- **1M-R4. Recognize relationships between concrete representations, number names, and symbolic representations of numbers (e.g., understand that three rocks can be represented as three circles, the numeral 3 and the word *three*)**

MATH STANDARDS

STANDARD 2: DATA ANALYSIS AND PROBABILITY

Students use data collection and analysis, statistics, and probability to make valid inferences, decisions and arguments and to solve a variety of real-world problems.

READINESS (Kindergarten)

- **2M-R1. Compare and sort objects by their physical attributes**
- **2M-R2. Collect, organize and describe simple data**
- **2M-R3. Construct concrete displays of data; read and interpret elementary tables, graphs and charts**

MATH STANDARDS

STANDARD 3: PATTERNS, ALGEBRA AND FUNCTIONS

Students use algebraic methods to explore, model and describe patterns, relationships, and functions involving numbers, shapes, data and graphs within a variety of real-world problem-solving situations.

READINESS (Kindergarten)

- **3M-R1. Create, describe and extend a variety of patterns, using concrete objects**
- **3M-R2. Recognize that the same patterns can emerge from a variety of manipulatives and real-world situations**

MATH STANDARDS

STANDARD 4: GEOMETRY

Students use geometric methods, properties and relationships as a means to recognize, draw, describe, connect, and analyze shapes and representations in the physical world.

READINESS (Kindergarten)

- **4M-R1. Identify, compare, classify, draw and make models of shapes**
- **4M-R2. Recognize geometry in their surroundings**

MATH STANDARDS

STANDARD 5: MEASUREMENT AND DISCRETE MATHEMATICS

Students make and use direct and indirect measurement, metric and U.S. customary, to describe and compare the real world and to prepare for the study of discrete functions, fractals and chaos which have evolved out of the age of technology.

READINESS (Kindergarten)

- **5M-R1. Recognize that a single object has different attributes (e.g., length, color, size, texture) that can be measured in different ways**
- **5M-R2. Compare and order objects according to observable attributes**
- **5M-R3. Use a variety of puzzles and games involving counting problems**

MATH STANDARDS

STANDARD 6: MATHEMATICAL STRUCTURE/LOGIC

Students use both inductive and deductive reasoning as they make conjectures and test the validity of arguments.

READINESS (Kindergarten)

- **6M-R1. Sort and classify objects according to observable attributes**
- **6M-R2. Justify their answers and reasoning processes**

MATH STANDARDS

STANDARD 1: NUMBER SENSE

Students develop number sense and use numbers and number relationships to acquire basic facts, to solve a wide variety of real-world problems, and to determine reasonableness of results.

FOUNDATIONS (Grades 1-3)

- **1M-F1. Represent and use numbers in equivalent forms through the use of physical models, drawings, word names and symbols (e.g., using concrete materials and fraction equivalents to represent and compare halves, thirds, fourths, eighths and tenths)**

PO 1. Make a model to represent a given whole number

PO 2. Identify a whole number represented by a model with a word name and symbol

PO 3. Construct equivalent forms of whole numbers (e.g., $15 + 5 = 10 + 10$)

PO 4. Make a model to represent a given fraction (e.g., geometric model -- shading a picture, set model --part of an egg carton) (halves, thirds and fourths)

PO 5. Identify the fraction represented by a model with a word name and symbol (halves, thirds and fourths)

PO 6. Identify a given model that is divided into equal fractional parts (halves, thirds and fourths)

MATH STANDARDS

- **1M-F2. Relate counting, grouping and place-value concepts to whole numbers (e.g., reading and writing the number represented when objects are grouped by thousands, hundreds, tens and ones)**

PO 1. Read whole numbers up to one thousand

PO 2. Write whole numbers up to one thousand

PO 3. Order whole numbers (e.g., smallest to largest, largest to smallest) up to one thousand

PO 4. Construct a model to represent place value concepts

PO 5. Write a whole number in expanded notation (e.g., $531 = 500 + 30 + 1$)

PO 6. Read aloud a whole number with correct place value words (e.g., a student will read 5 2 1 as “five hundred twenty-one”)

PO 7. Count money to \$5.00 using bills and coins

MATH STANDARDS

- **1M-F3. Understand the meaning for and application of the operations of addition, subtraction, multiplication and division**

PO 1. Demonstrate with models to show the process used in addition (joins things together, increases)

PO 2. Demonstrate with models to show the process used in subtraction (takes away, compares, finds the difference, decreases)

PO 3. Demonstrate with models to show the process used in multiplication (uses repeated addition, counts by multiples, combines things that come in groups of equal size, makes arrays, uses area models)

PO 4. Demonstrate with models to show the process used in division (puts things into groups of equal size, shares equally, uses repeated subtraction)

PO 5. Demonstrate with models the operations of addition and subtraction up to two three-digit whole numbers

PO 6. Select appropriate operations to solve word problems

PO 7. Solve word problems using the appropriate operations

PO 8. Apply mathematical operations in everyday situations

MATH STANDARDS

- **1M-F4. Demonstrate proficiency with the operations of addition and subtraction of whole numbers**

Note: Proficiency: accurate and consistent solving of computational problems in a reasonable time, using self-checking skills

PO 1. Demonstrate proficiency with basic facts up to 20

PO 2. Add and subtract two three-digit whole numbers

PO 3. Solve problems using a variety of mental computations and estimation

- **1M-F5. Demonstrate proficiency with the operations of multiplication and division of single-digit numbers**

PO 1. Demonstrate proficiency with basic facts up to the fives

PO 2. Solve problems using a variety of mental computations and estimation

- **1M-F6. Add and subtract commonly used fractions and decimals**

PO 1. Demonstrate with models addition and subtraction of fractions with common denominators (halves, thirds and fourths)

PO 2. Add and subtract money up to \$5.00

MATH STANDARDS

- **1M-F7. Select and use appropriate techniques to facilitate computation (e.g., mental, estimation, paper-and-pencil, calculator and computer methods) while solving problems and determining the reasonableness of results**

PO 1. Select a computational technique to solve a problem

PO 2. Solve a problem using the appropriate computational techniques

PO 3. Evaluate the reasonableness of results using a variety of mental computation and estimation techniques (e.g., compatible numbers, front-end, chunking)

PO 4. Use technology (e.g., calculators, computers, multimedia) to solve problems containing larger numbers

MATH STANDARDS

STANDARD 2: DATA ANALYSIS AND PROBABILITY

Students use data collection and analysis, statistics, and probability to make valid inferences, decisions and arguments and to solve a variety of real-world problems.

FOUNDATIONS (Grades 1-3)

- **2M-F1. Collect and analyze data using the concepts of largest, smallest, most often, least often and middle**

PO 1. Collect and record data from surveys (e.g., favorite color or food, height, ages) or experiments

PO 2. Organize (e.g., sorting, sequencing, tallying) information from surveys or experiments

PO 3. Identify largest, smallest, most often recorded (i.e., mode), least often and middle (i.e., median) using sorted data

PO 4. Formulate questions from organized data

MATH STANDARDS

- **2M-F2. Construct, read and interpret displays of data to make valid decisions, inferences and predictions**

PO 1. Make and label a graph (horizontal bar, vertical bar, picture graph or tally chart) from organized data

PO 2. Answer questions about a circle graph (i.e., pie graph) divided into halves and fourths

PO 3. Answer questions about a pictograph where each symbol represents multiple units

PO 4. Write a title representing the main idea of a graph

PO 5. Locate points on a line graph (grid) using ordered pairs

PO 6. Draw conclusions (e.g., valid decisions, conjectures and predictions) from graphed data

PO 7. Formulate questions from graphs, charts and tables

PO 8. Solve problems using graphs, charts and tables (e.g., given a bar graph on preferred flavors of ice cream, students have to decide what flavors of ice cream to order)

MATH STANDARDS

- **2M-F3. Predict and measure the likelihood of events and recognize that the results of an experiment may not match predicted outcomes**

Note: Probability experiments are simple one-step activities, e.g., tossing a two-colored counter

PO 1. Collect and record data from a probability experiment

PO 2. Organize (e.g., sorting, sequencing, tallying) data from a probability experiment

PO 3. Name the possible outcomes of the probability experiment

PO 4. Predict the most likely or least likely outcome in probability experiments

PO 5. Compare the outcome of the experiment to the predictions

- **2M-F4. Understand the concept of sample (i.e., that a larger sample of observed outcomes leads to more reliable information)**

PO 1. Compare data from probability experiments in which the experiments are performed a different number of times with the given expected outcomes (e.g., toss a two-colored counter 10 times and record the data; toss the counter 20 times and record the data; compare the results to the expected outcome [1 out of 2])

MATH STANDARDS

STANDARD 3: PATTERNS, ALGEBRA AND FUNCTIONS

Students use algebraic methods to explore, model and describe patterns, relationships, and functions involving numbers, shapes, data and graphs within a variety of real-world problem-solving situations.

FOUNDATIONS (Grades 1-3)

- **3M-F1. Create, describe and extend a variety of patterns using shapes, events, designs and numbers**

Note: Types of patterns: manipulatives, symbols, words, numbers and pictures

PO 1. Create a pattern using a model (e.g., symbolically: numbers or letters; visually: shapes, designs, numbers or pictures; auditorially: clapping, singing or listening; and kinesthetically: dancing, movement or tactile)

PO 2. Communicate orally or in written form the repetition of objects in a pattern

PO 3. Communicate orally or in written form a given pattern occurring in a sequence of numbers (e.g., counting by 10's, 5's, 3's, 2's, odd, even, forward and backward)

PO 4. Extend patterns using a model

PO 5. Extend a given pattern occurring in a sequence of numbers

- **3M-F2. Formulate generalizations about patterns (e.g., color, shape, size, direction, orientation) to make predictions**

PO 1. Make predictions based on a given pattern

MATH STANDARDS

- **3M-F3. Represent and describe how changing the value of one variable results in a change in another**

PO 1. Describe in a given situation how a change in one variable results in the change of another (e.g., if you have to share a batch of cookies with friends, the more friends you have, the fewer cookies you'll each get)

- **3M-F4. Represent and describe mathematical relationships such as order, grouping, etc. (e.g., given a string of numbers, describe the pattern, define the relationship between the numbers and determine the next number in line)**

PO 1. Identify the pattern in skip counting

PO 2. Determine the next number in a skip counting pattern

- **3M-F5. Recognize the symbols of equality and inequality**

PO 1. Use the symbols $<$, $>$, $=$ to compare whole numbers

- **3M-F6. Find missing elements in number sentences**

PO 1. Find the missing number in addition and subtraction number sentences

MATH STANDARDS

STANDARD 4: GEOMETRY

Students use geometric methods, properties and relationships as a means to recognize, draw, describe, connect, and analyze shapes and representations in the physical world.

FOUNDATIONS (Grades 1-3)

- **4M-F1. Relate geometric concepts to number and measurement ideas (e.g., dividing a rectangle into parts to represent multiplication)**

Note: Two-dimensional shapes: square, rectangle, triangle, circle

Three-dimensional figures: sphere, cube, rectangular prism (box), cone, pyramid

Attributes: size; shape; the number of sides, corners and faces

PO 1. Identify two-dimensional shapes by name and attribute

PO 2. Draw two-dimensional shapes

PO 3. Identify three-dimensional figures by name and/or attribute

PO 4. Compare attributes of two-dimensional shapes

PO 5. Compare attributes of three-dimensional figures

PO 6. Use a rectangular array to represent a multiplication fact (e.g., put 12 tiles in a rectangular array; make a 3 x 4, 6 x 2, and 12 x 1 array)

- **4M-F2. Predict how shapes can be changed by combining or dividing them**

PO 1. Build geometric shapes with other common shapes (e.g. tangrams, pattern blocks, geoboards)

MATH STANDARDS

STANDARD 5: MEASUREMENT AND DISCRETE MATHEMATICS

Students make and use direct and indirect measurement, metric and U.S. customary, to describe and compare the real world and to prepare for the study of discrete functions, fractals and chaos which have evolved out of the age of technology.

FOUNDATIONS (Grades 1-3)

- **5M-F1. Demonstrate that a single object has different attributes that can be measured in different ways (e.g., length, mass/weight, time, temperature, area and volume)**

PO 1. Determine the characteristics (attributes) of an object that are measurable (e.g., length and weight are measurable; color and texture are not measurable)

PO 2. Identify the type of measure (e.g., weight, height, volume) for each attribute

MATH STANDARDS

- **5M-F2. Explain the concepts related to units of measure and demonstrate the process of measurement with non-standard (e.g., using paper clip lengths), U.S. customary and metric units**

PO 1. Select the appropriate unit of measure for a given characteristic of an object

-*length* - inches, feet and yards; centimeters and meters

-*capacity/volume* - cups, gallons and liters

-*mass/weight* - ounces, pounds, grams and kilograms

PO 2. Select the appropriate tool (e.g., ruler, thermometer, measuring cup, scale) to measure the given characteristic of an object

PO 3. Measure a given characteristic of an object using non-standard units of measure

PO 4. Measure a given characteristic of an object using standard units of measure

PO 5. Tell time to the nearest minute on digital and traditional (analog) clocks

PO 6. Determine the passage of time (i.e., units of days, months and years) using a calendar

PO 7. Compare units of measure to determine *more* or *less* relationships

-*length* - inches and feet, feet and yards, centimeters and meters

-*capacity* - cups and gallons

-*mass* - ounces and pounds grams and kilograms

-*time* - minutes and hours, hours and days, days and weeks, months and years

-*money* - pennies, nickels, dimes, quarters and dollars

MATH STANDARDS

- **5M-F2. Explain the concepts related to units of measure and demonstrate the process of measurement with non-standard (e.g., using paper clip lengths), U.S. customary and metric units**

PO 8. Compare units of measure to determine equivalent relationships

-*length* - inches to feet

-*time* - minutes to hours, days to weeks, months to years

-*money* - pennies, nickels, dimes, quarters to dollars

PO 9. Read a thermometer in Celsius and Fahrenheit to the nearest degree

- **5M-F3. Make estimates of measurement**

PO 1. Estimate a measurement

PO 2. Compare the estimation to actual measure

PO 3. Evaluate the reasonableness of the estimation

- **5M-F4. Use discrete mathematical models for graphs to represent everyday situations (e.g., determine how many ways to move from point A to point B on a grid)**

PO 1. Make a diagram to represent the number of combinations between two sets (e.g., “How many outfits can one make with three different colors of shirts and two different pairs of pants?”)

MATH STANDARDS

STANDARD 6: MATHEMATICAL STRUCTURE/LOGIC

Students use both inductive and deductive reasoning as they make conjectures and test the validity of arguments.

FOUNDATIONS (Grades 1-3)

- **6M-F1. Recognize that numbers are used for different purposes in the world and a variety of mathematical notations represent these situations**

PO 1. Formulate mathematical problems from everyday situations

- **6M-F2. Draw inductive and deductive conclusions about mathematics**

PO 1. Extend a pattern using inductive reasoning (e.g., “What is the next number after 2, 4, 6, 8?”)

PO 2. Make a prediction based on existing information (e.g., “All the students in a 3rd grade class are under 10 years old. How old will the next new student probably be?”)

- **6M-F3. Distinguish between relevant and irrelevant information**

PO 1. Select the information necessary to solve a given problem

- **6M-F4. Interpret statements made with precise language of logic (e.g., all, every, none, some, or, many)**

PO 1. Use words such as *all*, *every*, *none*, *some* and *many* to make reasonable conclusions about situations

MATH STANDARDS

STANDARD 1: NUMBER SENSE

Students develop number sense and use numbers and number relationships to acquire basic facts, to solve a wide variety of real-world problems, and to determine the reasonableness of results.

ESSENTIALS (Grades 4-8)

(Grades 4-5)

- **1M-E1. Read, write and order integers, whole numbers and rational numbers**

PO 1. Compare and order using concrete or illustrated models

- A. whole numbers (to millions)
- B. common fractions (halves, thirds, fourths, eighths)
- C. decimals (thousandths)

PO 2. Represent place value using concrete or illustrated models

- A. whole numbers (millions), decimals (thousandths)

PO 3. Read and write whole numbers, integers, common fractions and decimals using real-world situations

- A. whole number (millions), decimals (thousandths), fractions (halves, thirds, fourths, eighths)

MATH STANDARDS

(Grades 4-5)

- **1M-E2. Relate the basic arithmetic operations to one another (e.g., multiplication and division are inverse operations)**

PO 1. Represent the process of multiplication as repeated addition, using **concrete or illustrative models**

A. whole numbers

PO 2. Represent the process of division as repeated subtraction, partitioning a group and partitioning a whole, using **concrete or illustrative models**

A. whole numbers

PO 3. Write the family of equations using inverse operations for a given set of numbers

A. whole numbers with addition/subtraction [(4 + 5 = 9, 5 + 4 = 9, 9 – 4 = 5, 9 – 5 = 4) and multiplication/division

- **1M-E3. Demonstrate proficiency with the operations of multiplication and division of whole numbers**

PO 1. Calculate multiplication/division

A. three-digit by two-digit to find the product

B. facts through 12

C. mental math and estimation with multiples of 10

D. one-digit divisor to find quotient with remainder

PO 2. Calculate multiplication and division problems using contextual situations

MATH STANDARDS

(Grades 4-5)

- **1M-E4. Develop and apply number theory concepts (e.g., primes, factors and multiples) to represent numbers in various ways**

PO 1. State the factors for a given whole number

PO 4. Sort numbers by their properties

A. odd, even

- **1M-E5. Represent and use numbers in equivalent forms (integers, fractions, percent, decimals, exponents, scientific notation and square roots)**

PO 2. Demonstrate the relationship and equivalency among

A. decimals, fractions and percents
(e.g., $1/2 = .5 = 50\%$ with halves, fourths and tenths)

- **1M-E6. Recognize that the degree of precision needed in calculating a number depends on how the results will be used and the instruments used to generate the measurements**

PO 2. Apply the appropriate strategy (e.g., estimation, approximation, rounding or exact numbers) when calculating to solve problems

PO 3. Demonstrate/describe the magnitude of

A. whole numbers (e.g., “How many apples in the orchard?”)

Recommend assessing at the district level:

PO 4. Interpret calculations and calculator results within a contextual situation

MATH STANDARDS

STANDARD 2: DATA ANALYSIS AND PROBABILITY

Students use data collection and analysis, statistics, and probability to make valid inferences, decisions and arguments and to solve a variety of real-world problems.

ESSENTIALS (Grades 4-8)

(Grades 4-5)

- **2M-E1. Construct, read, analyze and interpret tables, charts, graphs and data plots (e.g., box-and-whisker, stem-and-leaf, and scatter plots)**

PO 1. Construct

- A. bar graphs, line graphs, frequency tables and Venn diagrams

PO 2. Interpret and analyze data from graphical representations and draw simple conclusions

- A. bar graphs, line graphs, circle graphs, frequency tables and Venn diagrams

- **2M-E2. Make valid inferences, predictions and arguments based on statistical analysis**

PO 1. Formulate predictions from a given set of data and justify predictions

PO 2. Compare a given prediction with the results of an investigation

- **2M-E3. Display and use measures of range and central tendency (i.e., mean, median and mode)**

PO 1. Find the mean, median, mode and range of data using **concrete and illustrative models**

MATH STANDARDS

(Grades 4-5)

- **2M-E4. Use counting strategies to determine all the possible outcomes of a particular event (e.g., the number of ways students can line up to have their pictures taken)**

PO 1. Find all possible outcome sets involving

- A. two sets of objects (e.g., shirts and pants)

- **2M-E5. Determine probabilities through experiments and/or simulations and compare the results with the mathematical expectation**

PO 1. Make predictions from the results of a student-generated experiment (empirical probability)

- A. single events (e.g., spinners)

PO 3. Describe events that are certain or impossible

PO 5. Identify outcomes that are more likely, less likely or equally likely to occur

MATH STANDARDS

STANDARD 3: PATTERNS, ALGEBRA AND FUNCTIONS

Students use algebraic methods to explore, model and describe patterns, relationships and functions involving numbers, shapes, data and graphs within a variety of real-world problem-solving situations.

ESSENTIALS (Grades 4-8)

(Grades 4-5)

- **3M-E1. Use algebraic methods (write number sentences, in the form of expressions and equations) to explore, model and describe patterns and functions involving numbers, shapes, data, graphs and data plots**

PO 1. Extend simple geometric and number patterns (e.g., 1, 1, 2, 1, 1, 3, 1, 1, 4...)

PO 2. Create simple geometric and number patterns

PO 3. Describe a rule for a simple pattern (e.g., 5, 10, 15, 20...rule = add five or count by fives)

- **3M-E2. Describe, represent and analyze patterns and relationships using shapes, tables, graphs, data plots, verbal rules and standard algebraic notations**

Note: this is covered in 3M-E1 and 3M-E4

- **3M-E3. Describe the concepts of variables, expressions, equations and inequalities**

Note: There are no POs at this level

MATH STANDARDS

(Grades 4-5)

- **3M-E4. Analyze functional relationships to explain how a change in one variable results in a change in another**

PO 1. Describe a real-life situation in which a change in one variable results in the change of the other (e.g., temperature in the classroom goes up and the amount of clothing goes down)

PO 3. Compute an “output” for a given “input” in a function

- **3M-E5. Use patterns and functions to represent and solve problems both formally and informally (e.g., measuring the height a ball bounces by dropping different balls from different starting heights)**

Note: There are no POs at this level

- **3M-E6. Distinguish between linear and nonlinear functions through investigations**

Note: There are no POs at this level

- **3M-E7. Solve simple linear equations and inequalities using a variety of methods (e.g., informal, formal, graphical) and a variety of manipulatives**

PO 1. Solve equations using

- A. whole numbers with one variable--one step

PO 3. Graph given data points to represent a linear equation

- A. on a coordinate grid with whole numbers

- **3M-E8. Develop, analyze and explain methods for solving proportions**

Note: There are no POs at this level

MATH STANDARDS

STANDARD 4: GEOMETRY

Students use geometric methods, properties and relationships as a means to recognize, draw, describe, connect, and analyze shapes and representations in the physical world.

ESSENTIALS (Grades 4-8)

(Grades 4-5)

- **4M-E1. Visualize and draw two- and three-dimensional geometric figures with special attention to analyzing and reasoning informally about their properties (e.g., parallelism, perpendicularity and congruence)**

PO 1. Classify two-dimensional shapes and three-dimensional figures by their properties

A. by sight

PO 2. Identify the properties of geometric figures using appropriate terminology and vocabulary (e.g., parallelism, perpendicularity and congruency)

A. two-dimensional shapes (three- and four-sided polygons)

PO 3. Draw or build two-dimensional shapes by applying significant properties of each (e.g., draw a rectangle with two sets of parallel sides and four right angles)

MATH STANDARDS

(Grades 4-5)

- **4M-E2. Apply geometric properties and relationships such as congruence, similarity, angle measure, parallelism and perpendicularity to real-world situations**

PO 1. Design or draw a model (e.g., designing a playhouse, garden) that demonstrates basic geometric relationships, such as

- A. parallelism, perpendicularity, similarity

PO 2. Classify triangles by their angles and sides (e.g., equilateral, acute, isosceles . . .)

PO 5. Identify lines that are parallel and perpendicular

PO 6. Distinguish shapes that are congruent

- **4M-E3. Perform elementary transformations (e.g., tessellations, flips, slides, rotations)**

PO 1. Demonstrate slide, flip or turn using concrete geometric figures

PO 2. Illustrate, using concrete or pictorial models

- A. slide, flip or turn (e.g., quilts)

PO 3. Draw or build a shape that

- A. has symmetry

- **4M-E4. Represent and solve problems relating to size, shape, area and volume using geometric models**

PO 1. Solve problems using **given** formulas for

- A. simple area and perimeter

PO 2. Identify a variety of shapes having the same perimeter and area

MATH STANDARDS

STANDARD 5: MEASUREMENT AND DISCRETE MATHEMATICS

Students make and use direct and indirect measurement, metric and U.S. customary, to describe and compare the real world and to prepare for the study of discrete functions, fractals and chaos which have evolved out of the age of technology.

ESSENTIALS (Grades 4-8)

(Grades 4-5)

- **5M-E1. Estimate, make and use measurements (U.S. customary and metric) to describe and make comparisons**

PO 1. Measure length, volume and weight in both U.S. customary and metric units

PO 2. Convert measurement units to equivalent units **within** a given system (customary and metric) (e.g., 12 inches = 1 foot, 10 decimeters = 1 meter)

PO 3. Estimate measurements for both U.S. customary and metric units within either system

- **5M-E2. Select and use appropriate units and tools to measure to the degree of accuracy required in a particular problem-solving situation**

PO 1. State the appropriate tool to measure in a particular situation (e.g., “What tool would you use to measure the top of your desk?”)

PO 2. State the appropriate unit of measurement in a particular situation (e.g., “What unit of measurement would you use to measure the top of your desk?”)

PO 3. Measure to the appropriate degree of accuracy to solve problems (e.g., measuring to the nearest sixteenth of an inch or using ounces, measuring to the nearest millimeter or using liters)

MATH STANDARDS

(Grades 4-5)

- **5M-E3. Estimate, use and describe measures of distance, perimeter, area, volume, capacity, weight, mass and angles**

PO 1. Differentiate between perimeter and area of quadrilaterals using concrete and illustrative models

PO 2. Record estimates and measurements:

- A. distance
- C. perimeter
- E. area
- G. weight

- **5M-E4. Develop and use formulas and procedures to solve problems involving measurement**

PO 1. Develop a procedure or formula to calculate

- A. area and perimeter of simple polygons

PO 2. Use **given** formulas to find

- A. area and perimeter of simple polygons

- **5M-E5. Describe how a change in the linear dimension of an object affects its perimeter, area and volume**

PO 1. Describe the change in perimeter and area when one dimension of an object is altered

MATH STANDARDS

(Grades 4-5)

- **5M-E6. Use calculators and computers to perform basic recursive and iterative processes**

PO 1. Solve a problem using the iterative process

- A. doubling (e.g., “If you get paid 1 cent the first day, 2 cents the second day, each day doubling the previous day’s pay, how much would you get paid on the twentieth day?”)

PO 2. Generate the iterative sequence for the next six terms when given the first four terms (e.g., 4, 7, 10, 13, . . .)

MATH STANDARDS

STANDARD 6: MATHEMATICAL STRUCTURE/LOGIC

Students use both inductive and deductive reasoning as they make conjectures and test the validity of arguments.

ESSENTIALS (Grades 4-8)

(Grades 4-5)

- **6M-E1. Use models to explain how ratios, proportions and percents can be used to solve problems and apply reasoning processes, such as spatial reasoning and reasoning with proportions and graphs**

Note: There are no POs at this level

- **6M-E2. Construct, use and explain algorithmic procedures for computing and estimating with whole numbers, fractions, decimals and integers**

PO 1. Design a method with a series of defined steps for solving a problem; justify the method

A. whole numbers

- **6M-E3. Use *if . . . then* statements to construct simple valid arguments**

PO 1. Construct simple valid arguments using *if . . . then* statements based on

A. graphic organizers (e.g., Venn diagrams and pictures . . .)

B. geometric shapes

MATH STANDARDS

STANDARD 1: NUMBER SENSE

Students develop number sense and use numbers and number relationships to acquire basic facts, to solve a wide variety of real-world problems, and to determine the reasonableness of results.

ESSENTIALS (Grades 4-8)

(Grades 6-8)

- **1M-E1. Read, write and order integers, whole numbers and rational numbers**

PO 1. Compare and order using concrete or illustrated models

D. rational numbers (e.g., -5, 1.2, $1\frac{3}{4}$, square root of 16)

PO 2. Represent place value using concrete or illustrated models

B. rational numbers (millions to millionths)

PO 3. Read and write whole numbers, integers, common fractions and decimals using real-world situations

B. rational numbers (millions to millionths)

MATH STANDARDS

(Grades 6-8)

- **1M-E2. Relate the basic arithmetic operations to one another (e.g., multiplication and division are inverse operations)**

PO 1. Represent the process of multiplication as repeated addition, using **concrete or illustrative models**

B. fractions and decimals

PO 2. Represent the process of division as repeated subtraction, partitioning a group and partitioning a whole, using **concrete or illustrative models**

B. fractions and decimals

PO 3. Write the family of equations using inverse operations for a given set of numbers

B. positive fractions and decimals, integers with addition/ subtraction and multiplication/division

- **1M-E3. Demonstrate proficiency with the operations of multiplication and division of whole numbers**

PO 1. Calculate multiplication/division

E. two-digit divisor, with remainders and rounding in context (e.g., percentages and money)

PO 2. Calculate multiplication and division problems using contextual situations

MATH STANDARDS

(Grades 6-8)

- **1M-E4. Develop and apply number theory concepts (e.g., primes, factors and multiples) to represent numbers in various ways**

PO 2. Factor a whole number into a product of its primes (prime factorization)

PO 3. Identify greatest common factor and least common multiples for a set of whole numbers

PO 4. Sort numbers by their properties

B. prime, composite, square, square root

PO 5. Simplify numerical expressions using order of operations

- **1M-E5. Represent and use numbers in equivalent forms (integers, fractions, percent, decimals, exponents, scientific notation and square roots)**

PO 1. Add, subtract, multiply and divide integers, positive fractions and decimals

PO 2. Demonstrate the relationship and equivalency among

B. decimals, fractions and percents

PO 3. Factor numbers into prime form and express in exponential form

PO 4. Convert standard notation to scientific notation and vice versa with positive exponents

PO 5. Determine the square root of a perfect square

MATH STANDARDS

(Grades 6-8)

- **1M-E6. Recognize that the degree of precision needed in calculating a number depends on how the results will be used and the instruments used to generate the measurements**

PO 1. Express answers to the appropriate place or degree of precision (e.g., time, money, pi)

PO 2. Apply the appropriate strategy (e.g., estimation, approximation, rounding or exact numbers) when calculating to solve problems

PO 3. Demonstrate/describe the magnitude of

- B. rational numbers (e.g., “How small is a bacterium?”)

Recommend assessing at the district level:

PO 4. Interpret calculations and calculator results within a contextual situation

MATH STANDARDS

STANDARD 2: DATA ANALYSIS AND PROBABILITY

Students use data collection and analysis, statistics, and probability to make valid inferences, decisions and arguments and to solve a variety of real-world problems.

ESSENTIALS (Grades 4-8)

(Grades 6-8)

- **2M-E1. Construct, read, analyze and interpret tables, charts, graphs and data plots (e.g., box-and-whisker, stem-and-leaf, and scatter plots)**

PO 1. Construct

- B. histograms, stem-and-leaf plots, scatter plots, circle graphs, and flow charts

PO 2. Interpret and analyze data from graphical representations and draw simple conclusions

- B. histograms, stem-and-leaf plots, scatter plots, circle graphs and flow charts

PO 3. Choose an appropriate graphic format to organize and represent data

- **2M-E2. Make valid inferences, predictions and arguments based on statistical analysis**

PO 1. Formulate predictions from a given set of data and justify predictions

PO 2. Compare a given prediction with the results of an investigation

PO 3. Critique the conclusions and recommendations of others' statistics

PO 4. Consider the effects of missing or incorrect information

MATH STANDARDS

(Grades 6-8)

- **2M-E3. Display and use measures of range and central tendency (i.e., mean, median and mode)**

PO 2. Find the mean, median, mode and range of a data set

PO 3. Choose appropriate measures of central tendencies to describe given or derived data

- **2M-E4. Use counting strategies to determine all the possible outcomes of a particular event (e.g., the number of ways students can line up to have their pictures taken)**

PO 1. Find all possible outcome sets involving

B. two or more sets of objects

PO 2. Find all possible arrangements given a set (e.g., “How many ways can you arrange a set of books on a shelf?”)

- **2M-E5. Determine probabilities through experiments and/or simulations and compare the results with the mathematical expectation**

PO 1. Make predictions from the results of a student-generated experiment (empirical probability)

B. two-stage events (e.g., two spinners)

PO 2. Determine and compare experimental (empirical) and mathematical (theoretical) probabilities (e.g., flipping two-colored counters)

PO 4. Express probability as a fraction, zero or one

MATH STANDARDS

STANDARD 3: PATTERNS, ALGEBRA AND FUNCTIONS

Students use algebraic methods to explore, model and describe patterns, relationships and functions involving numbers, shapes, data and graphs within a variety of real-world problem-solving situations.

ESSENTIALS (Grades 4-8)

(Grades 6-8)

- **3M-E1. Use algebraic methods (write number sentences, in the form of expressions and equations) to explore, model and describe patterns and functions involving numbers, shapes, data, graphs and data plots**

PO 4. Generate patterns using algebraic expressions

- **3M-E2. Describe, represent and analyze patterns and relationships using shapes, tables, graphs, data plots, verbal rules and standard algebraic notations**

Note: this is covered in 3M-E1 and 3M-E4

- **3M-E3. Describe the concepts of variables, expressions, equations and inequalities**

PO 1. Describe and use variables in a contextual situation

PO 2. Evaluate an expression using substitution with four basic operations on whole numbers

PO 3. Translate a written phrase to an algebraic expression and vice versa (words to symbols and symbols to words) (e.g., the quotient of x and y)

PO 4. Express a simple inequality from a contextual situation (e.g., Joe earns more than \$5.00 an hour; therefore, $x > 5$)

MATH STANDARDS

(Grades 6-8)

- **3M-E4. Analyze functional relationships to explain how a change in one variable results in a change in another**

PO 2. Produce the rule (function) that explains the relationship (pattern) between the numbers when a change in the first variable effects the second variable (T-chart, two-row table, or input/output machine)

PO 4. Complete a T-chart for a given rule

- **3M-E5. Use patterns and functions to represent and solve problems both formally and informally (e.g., measuring the height a ball bounces by dropping different balls from different starting heights)**

PO 1. Solve a problem given a pattern both formally and informally (e.g., “In a patterned necklace, how many red and green beads do you need for a 20-inch necklace?”)

- **3M-E6. Distinguish between linear and nonlinear functions through investigations**

PO 1. Distinguish between linear and nonlinear functions, given graphic examples

MATH STANDARDS

(Grades 6-8)

- **3M-E7. Solve simple linear equations and inequalities using a variety of methods (e.g., informal, formal, graphical) and a variety of manipulatives**

PO 1. Solve equations using

- B. whole numbers with one variable--multiple steps

PO 2. Solve linear (first degree) equations using models/manipulatives, symbols and/or graphing in a one-step equation

PO 3. Graph given data points to represent a linear equation

- B. n (x, y) form using all four quadrants of a coordinate grid

- **3M-E8. Develop, analyze and explain methods for solving proportions**

PO 1. Describe how to solve a problem in context using a proportion

PO 2. Compare quantities using ratios

PO 3. Solve proportions using formal (e.g., cross product) or informal methods (e.g., diagrams, geometric models)

MATH STANDARDS

STANDARD 4: GEOMETRY

Students use geometric methods, properties and relationships as a means to recognize, draw, describe, connect, and analyze shapes and representations in the physical world.

ESSENTIALS (Grades 4-8)

(Grades 6-8)

- **4M-E1. Visualize and draw two- and three-dimensional geometric figures with special attention to analyzing and reasoning informally about their properties (e.g., parallelism, perpendicularity and congruence)**

PO 1. Classify two-dimensional shapes and three-dimensional figures by their properties

B. by properties

PO 2. Identify the properties of geometric figures using appropriate terminology and vocabulary (e.g., parallelism, perpendicularity and congruency)

B. three-dimensional figures (prisms)

PO 3. Draw or build three-dimensional figures by applying significant properties of each (e.g., draw a rectangle with two sets of parallel sides and four right angles)

MATH STANDARDS

(Grades 6-8)

- **4M-E2. Apply geometric properties and relationships such as congruence, similarity, angle measure, parallelism and perpendicularity to real-world situations**

PO 1. Design or draw a model (e.g., designing a playhouse, garden) that demonstrates basic geometric relationships, such as

- B. all of the above and proportionality and congruency

PO 3. Label corresponding, supplementary and complementary angles

PO 4. Measure and label specified angles (e.g., alternate interior, obtuse, acute, right, corresponding...)

- **4M-E3. Perform elementary transformations (e.g., tessellations, flips, slides, rotations)**

PO 2. Illustrate, using concrete or pictorial models

- B. reflections, rotations and translations (e.g., tessellations)

PO 3. Draw or build a shape that

- B. has two or more lines of symmetry

- **4M-E4. Represent and solve problems relating to size, shape, area and volume using geometric models**

PO 1. Solve problems using **given** formulas for

- B. area, perimeter /circumference of various circles/polygons

- C. volume of prisms

PO 3. Draw or build a variety of shapes having the same perimeter and area

MATH STANDARDS

STANDARD 5: MEASUREMENT AND DISCRETE MATHEMATICS

Students make and use direct and indirect measurement, metric and U.S. customary, to describe and compare the real world and to prepare for the study of discrete functions, fractals and chaos which have evolved out of the age of technology.

ESSENTIALS (Grades 4-8)

(Grades 6-8)

- **5M-E1. Estimate, make and use measurements (U.S. customary and metric) to describe and make comparisons**

PO 3. Estimate measurements for both U.S. customary and metric units within either system

PO 4. Compare estimated measurements **between** U.S. customary and metric systems (e.g., a yard is about a meter)

- **5M-E2. Select and use appropriate units and tools to measure to the degree of accuracy required in a particular problem-solving situation**

PO 3. Measure to the appropriate degree of accuracy to solve problems (e.g., measuring to the nearest sixteenth of an inch or using ounces, measuring to the nearest millimeter or using liters)

MATH STANDARDS

(Grades 6-8)

- **5M-E3. Estimate, use and describe measures of distance, perimeter, area, volume, capacity, weight, mass and angles**

PO 2. Record estimates and measurements for

- B. distance in scale drawings
- D. circumference
- E. area
- F. volume
- H. mass
- I. degrees of angles
- J. capacity

PO 3. Compare weight to mass and capacity to volume

- **5M-E4. Develop and use formulas and procedures to solve problems involving measurement**

PO 1. Develop a procedure or formula to calculate

- B. area of polygons and circles
- C. surface area of rectangular prisms
- D. volume of rectangular prisms

PO 2. Use **given** formulas to find

- B. circumference of a circle
- C. area of polygons and circles
- D. surface area of rectangular prisms
- E. volume of prisms

MATH STANDARDS

(Grades 6-8)

- **5M-E5. Describe how a change in the linear dimension of an object affects its perimeter, area and volume**

PO 2. Describe the effect on perimeter, area and volume when one dimension of an object is altered

- **5M-E6. Use calculators and computers to perform basic recursive and iterative processes**

PO 1. Solve a problem using the iterative process

- B. designing a simple geometric pattern (e.g., design a basic quilt block; use it to generate the whole quilt)

PO 3. Complete the iterative sequence (e.g., given these terms and assuming a constant difference 21, -, -, -, -, 63, -, -, -)

PO 4. Generate subsequent terms of a recursive sequence (e.g., 3, 3, 6, 9, 15, . . .)

MATH STANDARDS

STANDARD 6: MATHEMATICAL STRUCTURE/LOGIC

Students use both inductive and deductive reasoning as they make conjectures and test the validity of arguments.

ESSENTIALS (Grades 4-8)

(Grades 6-8)

- **6M-E1. Use models to explain how ratios, proportions and percents can be used to solve problems and apply reasoning processes, such as spatial reasoning and reasoning with proportions and graphs**

PO 1. Communicate how to solve problems involving ratios, proportions and percents using concrete and illustrative models

- **6M-E2. Construct, use and explain algorithmic procedures for computing and estimating with whole numbers, fractions, decimals and integers**

PO 1. Design a method with a series of defined steps for solving a problem; justify the method

B. fractions, decimals and integers

- **6M-E3. Use *if . . . then* statements to construct simple valid arguments**

PO 1. Construct simple valid arguments using *if . . . then* statements based on

B. geometric shapes

C. proportional reasoning in probability

D. syllogism

PO 2. Solve problems using deductive reasoning

MATH STANDARDS

STANDARD 1: NUMBER SENSE

Students develop number sense and use numbers and number relationships to acquire basic facts, to solve a wide variety of real-world problems, and to determine the reasonableness of results.

PROFICIENCY (Grades 9-12)

- **1M-P1. Compare and contrast the real number system and its various subsystems with regard to their structural characteristics**

Core – will be tested on AIMS

PO 1. Classify numbers as members of the sets (natural, whole, integers, rationals and irrationals)

Core – to be taught in gr 9-10

PO 2. Compare subsets of the real number system with regard to their properties (commutative, associative, distributive, identity, inverse and closure properties)

PO 4. Identify whether a given set of numbers is finite or infinite

{PO 3 Deleted}

MATH STANDARDS

- **1M-P2. Construct, interpret and demonstrate meaning for real numbers and absolute value in problem-solving situations**

Core – will be tested on AIMS

PO 1. Determine a rational estimate of an irrational number

PO 3. Solve real-world distance problems using absolute value

PO 4. Determine, among the solutions to a real-world problem, which, if any, is reasonable

PO 6. Choose the appropriate signed real number to represent a real-world value

PO 7. Use the appropriate form of a real number to express a real-world situation (e.g., choosing between a radical expression or rational approximation)

PO 8. Convert standard notation to scientific notation, including negative exponents, and vice versa

Core – to be taught in gr 9-10

PO 2. Define *absolute value* as the distance from the origin

{PO 5 Moved to 4M-P4, PO 4}

MATH STANDARDS

STANDARD 2: DATA ANALYSIS AND PROBABILITY

Students use data collection and analysis, statistics, and probability to make valid inferences, decisions and arguments and to solve a variety of real-world problems.

PROFICIENCY (Grades 9-12)

- **2M-P1. Construct and draw inferences including measures of central tendency, from charts, tables, graphs and data plots that summarize data from real-world situations**

Core – will be tested on AIMS

PO 1. Organize collections of data into frequency charts, stem-and-leaf plots, scatter plots

PO 2. Construct histograms, line graphs, circle graphs and box-and-whisker plots

PO 4. Evaluate the reasonableness of conclusions drawn from data analysis

PO 5. Use mean, median, mode, quartiles and range as a means for effective decision making in analyzing the data and the outliers

PO 6. Identify graphic misrepresentations and distortions of sets of data (e.g., omissions of parts of axis range, unequal interval sizes)

Core to be taught in gr 9-10

PO 3. Draw inferences from collections of data

MATH STANDARDS

- **2M-P2. Use appropriate technology (e.g., graphing calculators, computer software) to display and analyze data**

Core – to be taught in gr 9-10

PO 1. Use appropriate technology to display data as lists, tables, matrices and plots

PO 2. Use appropriate technology to calculate mean, median, mode, minimum and maximum

PO 3. Use appropriate technology to predict patterns in sets of data (e.g., “Does a scatter plot appear to be linear?”)

- **2M-P3. Apply curve fitting to make predictions from data**

Core – will be tested on AIMS

PO 1. Draw a line which closely fits a scatter plot

PO 2. Make a prediction from a linear pattern in plots of data

Beyond Core*

PO 1. Draw a curve which closely fits a scatter plot

- **2M-P4. Explain the effects of sampling on statistical claims and recognize misuses of statistics**

Core – will be tested on AIMS

PO 1. Differentiate between sampling and census

PO 2. Differentiate between a biased and an unbiased sample

PO 3. Recognize the impact of interpreting data from a biased sample

- P-4** **Beyond Core –appropriate to be taught after a grounding in core instruction, but will not be tested on AIMS*

MATH STANDARDS

- **2M-P4. Explain the effects of sampling on statistical claims and recognize misuses of statistics**

Beyond Core

PO 4. Distinguish the effects of using statistical measures obtained from a sample vs. those obtained from a census

PO 5. Recognize the misinterpretations of data from different representations of those same data

PO 6. Determine the validity of sampling methods in studies

- **2M-P5. Design and conduct a statistical experiment to study a problem and interpret and communicate the outcomes**

Beyond Core

PO 1. Design a statistical experiment based on a given hypothesis

PO 2. Create an appropriate data gathering instrument (e.g., biased vs. unbiased questions, multiple choice vs. open-ended)

PO 3. Organize collected data into an appropriate graphical representation

PO 4. Draw and support inferences that are based on data analysis

MATH STANDARDS

- **2M-P6. Use experimental or theoretical probability, as appropriate, to represent and solve problems involving uncertainty**

Beyond Core

PO 1. Recognize whether experimental or theoretical methods were used to calculate a particular probability

PO 2. Use experimental observations to estimate probabilities of entire populations

PO 3. Distinguish between independent and dependent events

PO 4. Solve probability problems involving *and* and *or* statements, with and without replacement

- **2M-P7. Use simulations to estimate probabilities**

Beyond Core

PO 1. Design appropriate simulations to estimate probabilities of real-world situations (e.g., disk toss, cube toss, technological simulations)

PO 2. Use simulations to estimate probabilities of real-world situations

MATH STANDARDS

- **2M-P8. Solve real-world problems by using combinations and permutations**

Core – will be tested on AIMS

PO 1. Use a tree diagram or a chart of possible outcomes to count probable outcomes of an event

Beyond Core

PO 2. Determine when to use combinations in counting objects

PO 3. Determine when to use permutations in counting objects

PO 4. Use combinations and permutations to solve real-world problems not requiring the use of formulas

- **2M-P9. Describe, in general terms, the normal curve and use its properties to answer questions about sets of data that are assumed to be normally distributed**

Beyond Core

PO 1. Determine if data gathered from a real-world situation fits a normal curve

PO 2. Describe the central tendency characteristics of the normal curve

PO 3. Make simple predictions from data represented on a given normal curve

- **2M-P10. Explain the concept of a random variable**

Beyond Core

PO 1. Distinguish situations where a random variable is needed or used

{PO 2 Deleted}

MATH STANDARDS

- **2M-P11. Apply measures of central tendency, variability and correlation**

Core – will be tested on AIMS

PO 1. Apply the concepts of mean, median, mode and range to draw conclusions about data

PO 3. Determine, from a given plot of data, whether it has positive or negative correlation

Beyond Core

PO 2. Draw conclusions about the “spread” of data given the variance and standard deviation (e.g., compare sets of data with the same central tendency, but with different variance)

MATH STANDARDS

STANDARD 3: PATTERNS, ALGEBRA AND FUNCTIONS

Students use algebraic methods to explore, model and describe patterns, relationships and functions involving numbers, shapes, data and graphs within a variety of real-world problem-solving situations.

PROFICIENCY (Grades 9-12)

- **3M-P1. Model real-world phenomena (e.g., compound interest or the flight of a ball) using functions and relations (e.g., linear, quadratic, sine and cosine, and exponential)**

Core – will be tested on AIMS

PO 2. Describe a real-world situation that is depicted by a given graph

Beyond Core

PO 1. Identify the independent and dependent variables from a real-world situation

Core – to be taught in gr 9-10

PO 3. Sketch a graph that models a given real-world situation

- **3M-P2. Represent and analyze relationships using written and verbal explanations, tables, equations, graphs and matrices and describe the connections among those representations**

Core – will be tested on AIMS

PO 3. Determine whether a relation is a function, given the graphical

Core – to be taught in gr 9-10

PO 1. Express the relationship between two variables using a table, equation, graph and matrix representation

{PO 2 Deleted}

MATH STANDARDS

- **3M-P3. Analyze the effects of parameter changes on functions (e.g., linear, quadratic and trigonometric) using calculators and/or computer**

Beyond Core

PO 1. Use technology to determine changes in the shape and behavior of polynomial functions (of degree 2 or less) when constants and coefficients are varied

- **3M-P4. Interpret algebraic equations and inequalities geometrically and describe geometric relationships algebraically**

Core – will be tested on AIMS

PO 1. Graph a linear equation in two variables

PO 2. Graph a linear inequality in two variables

PO 3. Determine slope and intercepts of a linear equation

PO 4. Write an equation of the line that passes through two given points

PO 5. Determine from two linear equations whether the lines are parallel, are perpendicular or coincide

- **3M-P5. Apply trigonometry to real-life problem situations (e.g., investigate how to find the distance across a river using similar triangles and trigonometric ratios; compare the sine and cosine curves to the curves of sound waves)**

Core – to be taught in gr 9-10

PO 1. Use the definitions of trigonometric functions to find the sine, cosine and tangent of the acute angles of a right triangle

Beyond Core

PO 2. Solve simple right-triangle trigonometric equations involving sine, cosine and tangent

PO 3. Use an appropriate right-triangle trigonometric model to solve a real-life problem

MATH STANDARDS

- **3M-P6. Perform mathematical operations on expressions and matrices, and solve equations and inequalities**

Core – will be tested on AIMS

PO 1. Simplify numerical expressions using the order of operations, including exponents

PO 2. Evaluate algebraic expressions using substitution

PO 3. Simplify algebraic expressions using distributive property

PO 4. Simplify square roots and cube roots with monomial radicands that are perfect squares or perfect cubes

PO 6. Evaluate numerical and algebraic absolute value expressions

PO 7. Multiply and divide monomial expressions with integer exponents

PO 9. Solve linear equations and inequalities in one variable

PO 10. Solve formulas for specified variables

PO 11. Solve quadratic equations (integral roots only)

PO 13. Solve proportions which generate linear equations

PO 15. Solve systems of linear equations in two variables (integral coefficients and solutions)

Core – to be taught in gr 9-10

PO 5. Calculate powers and roots of real numbers, both rational and irrational, using technology

PO 14. Solve absolute value equations containing a single absolute value expression

MATH STANDARDS

- **3M-P6. Perform mathematical operations on expressions and matrices, and solve equations and inequalities**

Beyond Core

PO 8. Add, subtract and perform scalar multiplication with matrices

PO 12. Solve radical equations involving one radical (restrict to square roots)

- **3M-P7. Translate among tabular, symbolic and graphical representations of functions**

Core – will be tested on AIMS

PO 1. Create a linear equation from a table of values

PO 2. Create a graph from a table of values

PO 3. Determine the solution to a system of equations in two variables, from a given graph

Core – to be taught in gr 9-10

PO 4. Determine the solution to a system of inequalities in two variables, from a given graph (e.g., “Which of the shaded regions represents the solution to the system?”)

MATH STANDARDS

- **3M-P8. Use the power of mathematical abstraction and algebraic symbolism to represent various situations**

Core – will be tested on AIMS

PO 1. Translate verbal expressions and sentences to mathematical expressions and sentences

PO 2. Generate an algebraic sentence to model real-life situations, given a data set (limited to linear relationships)

- **3M-P9. Determine maximum and minimum points of a graph and interpret results in problem situations**

Core – will be tested on AIMS

PO 2. Determine domain and range of a relation, given the graph or a set of points

{PO 1 and PO 3 Deleted}

- **3M-P10. Investigate the limiting process by examining infinite sequences and series and areas under curves**

Beyond Core

PO 1. Compare the estimates of the area under a curve over a bounded interval, using progressively smaller rectangles (not using calculus)

PO 2. Estimate the limit of a given infinite sequence (e.g., given the sequence $1/n$, as n gets larger) (not using calculus)

MATH STANDARDS

STANDARD 4: GEOMETRY

Students use geometric methods, properties and relationships as a means to recognize, draw, describe, connect, and analyze shapes and representations in the physical world.

PROFICIENCY (Grades 9-12)

- **4M-P1. Interpret and draw three-dimensional objects**

Core – will be tested on AIMS

PO 1. Sketch prisms, pyramids, cones, cylinders and spheres

PO 2. Classify prisms, pyramids, cones, cylinders and spheres by base shape, lateral surface shape

PO 3. Recognize the three-dimensional figure represented by a two-dimensional drawing (e.g., “What figures are represented by given nets, sketches, photographs?”)

- **4M-P2. Represent problem situations with geometric models and apply properties of figures**

Core – will be tested on AIMS

PO 1. Calculate surface areas and volumes of three-dimensional geometric figures, given the required formulas

PO 2. Solve applied problems using angle and side length relationships

PO 3. Solve applied problems using the Pythagorean theorem (e.g., determine whether a wall is square)

PO 4. Solve applied problems using congruence and similarity relationships of triangles (e.g., estimate the height of a building, using shadows)

PO 6. Determine the distance and midpoint between points within a coordinate system representative of a practical application

MATH STANDARDS

- **4M-P2. Represent problem situations with geometric models and apply properties of figures**

Continued

Core – will be tested on AIMS

PO 7. Find the area of a geometric figure composed of a combination of two or more geometric figures, given an appropriate real-world situation and the formulas

PO 8. Solve problems involving complementary, supplementary and congruent angles

Core – to be taught in gr 9-10

PO 5. Make a model of a three-dimensional figure from a two-dimensional drawing and make a two-dimensional representation of a three-dimensional object (models and representations include scale drawings, perspective drawings, blueprints or computer simulations)

- **4M-P3. Deduce properties of figures using transformations in coordinate systems, identifying congruency and similarity**

Core – will be tested on AIMS

PO 1. Determine whether a planar figure is symmetric with respect to a line

PO 3. Determine the effects of a transformation on linear and area measurements of the original planar figure

PO 4. Sketch the planar figure that is the result of a given transformation

Core – to be taught in gr 9-10

PO 2. Give the new coordinates of a transformed geometric planar figure

MATH STANDARDS

- **4M-P4. Deduce properties of, and relationships between, figures from given assumptions**

Core – will be tested on AIMS

PO 1. Find similarities and differences among geometric shapes and designs using a given attribute (e.g., height, area, perimeter, diagonals and angle measurements)

PO 2. Identify arcs, chords, tangents and secants of a circle

PO 3. State valid conclusions using given definitions, postulates and theorems

PO 4. Represent π as the ratio of circumference to diameter

- **4M-P5. Translate between synthetic and coordinate representations (e.g., a straight line is represented by the algebraic equation $Ax + By = C$)**

Core – will be tested on AIMS

PO 1. Determine the relative placement of two lines on a coordinate plane by examining the algebraic equations representing them

Core – to be taught in gr 9-10

PO 2. Verify characteristics of a given geometric figure using coordinate formulas such as distance, mid-point, and slope to confirm parallelism, perpendicularity, and congruency

MATH STANDARDS

- **4M-P6. Recognize and analyze Euclidean transformations (e.g., reflections, rotations, dilations and translations)**

Core – will be tested on AIMS

PO 1. Classify transformations based on whether they produce congruent or similar non-congruent figures

PO 2. Determine whether a given pair of figures on a coordinate plane represents a translation, reflection, rotation and/or dilation

Core – to be taught in gr 9-10

PO 3. Apply transformational principles to practical situations (e.g., enlarge a photograph)

MATH STANDARDS

STANDARD 5: MEASUREMENT AND DISCRETE MATHEMATICS

Students make and use direct and indirect measurement, metric and U.S. customary, to describe and compare the real world and to prepare for the study of discrete functions, fractals and chaos which have evolved out of the age of technology.

PROFICIENCY (Grades 9-12)

- **5M-P1. Represent problem situations using discrete structures such as finite graphs, matrices, sequences and recurrence relations**

Beyond Core

PO 1. Use matrices and finite graphs to display data

PO 2. Find a specified n^{th} term of a simple arithmetic or geometric sequence, where the common difference or common ratio is an integer and $n > 100$

PO 3. Use simple or basic recursion formulas to solve real-life problems (e.g., compound interest)

- **5M-P2. Represent and analyze finite graphs using matrices**

Beyond Core

PO 1. Interpret data using matrices and finite graphs (e.g., networks, street diagrams, tournament schedules, production schedules)

PO 2. Determine when a finite graph gives an accurate picture of a data set

PO 3. Translate a finite graph into a matrix and vice versa

MATH STANDARDS

- **5M-P3. Develop and analyze algorithms**

Core – will be tested on AIMS

PO 2. Determine the purpose of a given algorithm (simple, basic **math** algorithm)

PO 3. Determine whether given algorithms are equivalent (simple, basic **math** algorithm)

Core – to be taught in gr 9-10

PO 1. Write an algorithm that explains a particular mathematical process (e.g., tell a younger child how to find the average of two numbers)

- **5M-P4. Solve enumeration and finite probability problems**

Core – will be tested on AIMS

PO 1. Find the outcome set of a situation

PO 2. Find the probability that a specific event will happen

PO 4. Determine the number of possible outcomes in a real-world situation using the counting principle and tree diagrams

Core – to be taught in gr 9-10

PO 3. Determine theoretical geometrical probabilities, given necessary formulas (e.g., “Given a circular target on a square base, what is the probability of hitting the circle with a dart, providing the dart goes inside the square?”)

{PO 5 Deleted}

MATH STANDARDS

STANDARD 6: MATHEMATICAL STRUCTURE/LOGIC

Students use both inductive and deductive reasoning as they make conjectures and test the validity of arguments.

PROFICIENCY (Grades 9-12)

- **6M-P1. Use inductive and deductive logic to construct simple valid arguments**

Core – will be tested on AIMS

PO 2. Produce a valid conjecture using inductive reasoning by generalizing from a pattern of observations (e.g., if $10^1 = 10$, $10^2 = 100$, $10^3 = 1000$, make a conjecture)

Core – to be taught in gr 9-10

PO 1. Construct a simple informal deductive proof (e.g., write a proof of the statement: “Given an airline schedule with cities and flight times, you can fly from Bombay to Mexico City”)

- **6M-P2. Determine the validity of arguments**

Core – will be tested on AIMS

PO 2. Draw a simple valid conclusion from a given *if . . . then* statement and a minor premise

PO 3. Distinguish valid arguments from invalid arguments

PO 4. List related *if . . . then* statements in logical order

MATH STANDARDS

- **6M-P2. Determine the validity of arguments**

Core – to be taught in gr 9-10

PO 1. Determine if the converse of a given statement is true or false

PO 6. Analyze assertions about everyday life by using principles of logic (e.g., examine the fallacies of advertising)

Beyond Core

PO 7. Recognize the difference between a statement verified by mathematical proof (i.e., a theorem) and one verified by empirical data (e.g., women score higher than men on vocabulary tests)

{PO 5 Deleted}

- **6M-P3. Formulate counterexamples and use indirect proof**

Core – will be tested on AIMS

PO 1. Construct a counterexample to show that a given invalid conjecture is false (e.g., Nina makes a conjecture that $x^3 > x^2$ for all values of x . Find a counterexample)

- **6M-P4. Make and test conjectures**

Beyond Core

PO 1. Write an appropriate conjecture given a certain set of circumstances

PO 2. Test a conjecture by constructing a logical argument or counterexample

- **6M-P5. Understand the logic of algebraic procedures**

Core – will be tested on AIMS

PO 1. Determine whether a given algebraic expression and a possible simplified form are equivalent (e.g., show that $(x + y)^2 = x^2 + y^2$ is invalid)

PO 2. Determine whether a given procedure for solving an equation is valid

MATH STANDARDS

STANDARD 1: NUMBER SENSE

Students develop number sense and use numbers and number relationships to acquire basic facts, to solve a wide variety of real-world problems, and to determine the reasonableness of results.

DISTINCTION (Honors)

- **1M-D1.Develop conceptual understanding of the complex number system**
- **1M-D2.Demonstrate facility with operations in the complex number system**

MATH STANDARDS

STANDARD 2: DATA ANALYSIS AND PROBABILITY

Students use data collection and analysis, statistics, and probability to make valid inferences, decisions and arguments and to solve a variety of real-world problems.

DISTINCTION (Honors)

- **2M-D1. Transform data to aid in data interpretation and prediction**
- **2M-D2. Test hypotheses using appropriate statistics**
- **2M-D3. Explain the concept of a random variable to generate and interpret probability distributions including binomial, uniform and normal**
- **2M-D4. Apply the concept of a random variable to generate and interpret probability distributions including binomial, uniform and normal**
- **2M-D5. Apply curve fitting to determine the strength of the relationship between two data sets and to make predictions from data**

MATH STANDARDS

STANDARD 3: PATTERNS,ALGEBRA AND FUNCTIONS

Students use algebraic methods to explore, model and describe patterns, relationships and functions involving numbers, shapes, data and graphs within a variety of real-world problem-solving situations.

DISTINCTION (Honors)

- **3M-D1. Use matrices to solve linear systems**
- **3M-D2. Demonstrate technical facility with algebraic transformations, including techniques based on the theory of equations**
- **3M-D3. Understand operations on, and the general principles and behavior of, classes of functions (including logarithmic functions)**
- **3M-D4. Apply general graphing techniques to trigonometric functions**
- **3M-D5. Solve trigonometric equations and verify trigonometric identities**
- **3M-D6. Understand the connections between trigonometric functions and polar coordinates, complex numbers and series**
- **3M-D7. Understand the conceptual foundations of limits, the area under a curve, the rate of change, and the slope of a tangent line, and their applications in other disciplines**
- **3M-D8. Analyze the graphs of polynomial, rational, radical and transcendental functions**

MATH STANDARDS

STANDARD 4: GEOMETRY

Students use geometric methods, properties and relationships as a means to recognize, draw, describe, connect and analyze shapes and representations in the physical world.

DISTINCTION (Honors)

- **4M-D1. Deduce properties of figures using vectors**
- **4M-D2. Apply transformations, coordinates and vectors in problem-solving**

MATH STANDARDS

STANDARD 5: MEASUREMENT AND DISCRETE MATHEMATICS

Students make and use direct and indirect measurement, metric and U.S. customary, to describe and compare the real world and to prepare for the study of discrete functions, fractals and chaos which have evolved out of the age of technology.

DISTINCTION (Honors)

- **5M-D1. Represent and solve problems using linear programming and difference equations**
- **5M-D2. Investigate problem situations that arise in connection with computer validation and the application of algorithms**
- **5M-D3. Describe, analyze and extend patterns produced by processes of geometric change such as fractals**

MATH STANDARDS

STANDARD 6: MATHEMATICAL STRUCTURE/LOGIC

Students use both inductive and deductive reasoning as they make conjectures and test the validity of arguments.

DISTINCTION (Honors)

- **6M-D1. Prove elementary theorems within various mathematical structures**
- **6M-D2. Develop an understanding of the nature and purpose of axiomatic systems**
- **6M-D3. Construct proofs for mathematical assertions, including indirect proofs and proofs by mathematical induction**

MATH STANDARDS